Worked Examples using R, *Introductory Statistics, 7th ed.* by Neil Weiss

Charles Carter*

October 1, 2014

Contents

*cccaqrter@troy.edu

Abstract

This paper consists of the worked examples in each chapter of *Introductory Statistics, 7th Edition* by Neil Weiss, using the R programming language

1 Chapter 1

1.1 Example 1.1, Descriptive Statistics

This example contains no code.

1.2 Example 1.2, Inferential Statistics

This example contains no code.

1.3 Example 1.3, Classifying Statistical Studies

This example contains no code.

1.4 Example 1.4, Classifying Statistical Studies

This example contains no code.

1.5 Example 1.5, Simple Random Samples

```
#create vector of officials
library(prob)
off <- c('G', 'L', 'S', 'A', 'T')
#part a, list of samples of size 2
urnsamples(off, 2)
```

```
##    X1 X2
## 1   G  L
## 2   G  S
## 3   G  A
## 4   G  T
## 5   L  S
## 6   L  A
## 7   L  T
## 8   S  A
## 9   S  T
## 10  A  T
```

```
#part d, list of samples of size 4
urnsamples(off, 4)
```

```
##   X1 X2 X3 X4
## 1  G  L  S  A
## 2  G  L  S  T
## 3  G  L  A  T
## 4  G  S  A  T
## 5  L  S  A  T
```

1.6 Example 1.6, Random-Number Tables

```
#generate 15 random integers between 1 and 728
sample(1:728, 15)
```

```
##  [1]  93 482 537 251 540 254 684 373 232 619  64 243  25 297 289
```

1.7 Example 1.7, Systematic Random Sampling

```
#declare variables
pop <- 728
sos <- 15
division <- floor(pop / sos)
division
```

```
## [1] 48
```

```
start <- sample(1:division, 1)
start
```

```
## [1] 46
```

```
#generate sequence
s <- seq(start, pop, division)
s
```

```
##  [1]  46  94 142 190 238 286 334 382 430 478 526 574 622 670 718
```

2 Chapter 2

3 Chapter 3

4 Chapter 4

5 Chapter 5

6 Chapter 6

6.1 Example 6.1,

6.2 Example 6.2,

6.3 Example 6.3,

6.4 Example 6.4,

6.5 Example 6.5,

6.6 Example 6.6,

6.7 Example 6.7,

6.8 Example 6.8,

6.9 Example 6.9,

6.10 Example 6.10,

6.11 Example 6.11,

6.12 Example 6.12,

6.13 Example 6.13, Using Technology to Obtain Normal Percentiles

```
mu <- 100
sigma <- 16
ptile <- qnorm(0.90, mu, sigma)
ptile
```

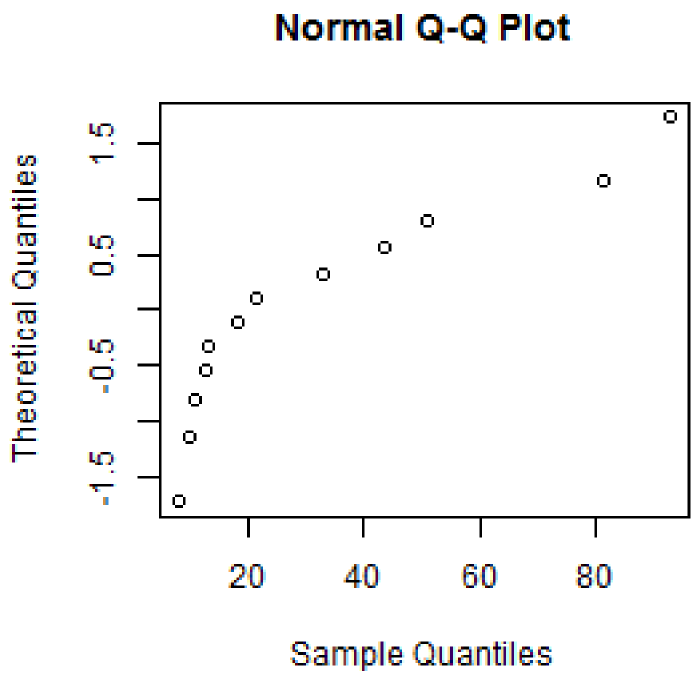
```
## [1] 120.5
```

6.14 Example 6.14, Normal Probability Plots

```
#read in the data
income <- read.csv("data/Tb06-03.txt")
str(income)
```

```
## 'data.frame': 12 obs. of  1 variable:
##  $ AGI: num  9.7 93.1 33 21.2 81.4 51.1 43.5 10.6 12.8 7.8 ...
```

```
qqnorm(income$AGI, datax = TRUE)
```



7 Chapter 7

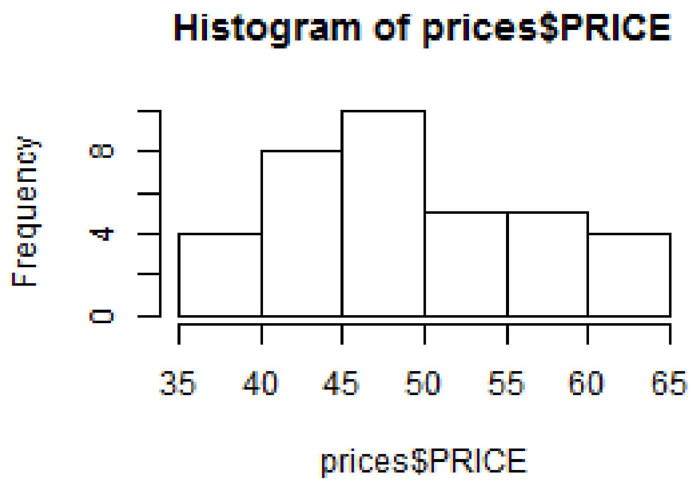
8 Chapter 8, Confidence Intervals for One Population Mean

8.1 Example 8.1, Estimating a Population Mean

```
#read in the data
prices <- read.csv("data/Tb08-01.txt")
str(prices)
```

```
## 'data.frame': 36 obs. of  1 variable:
##  $ PRICE: num  53.8 54.4 45.2 42.9 49.9 48.2 41.6 58.9 48.6 53.1 ...
```

```
hist(prices$PRICE, breaks = 5)
```




```r
sum <- sum(prices$PRICE)
n <- nrow(prices)
mu <- sum / n
#alternatively
mu1 <- mean(prices$PRICE)
```

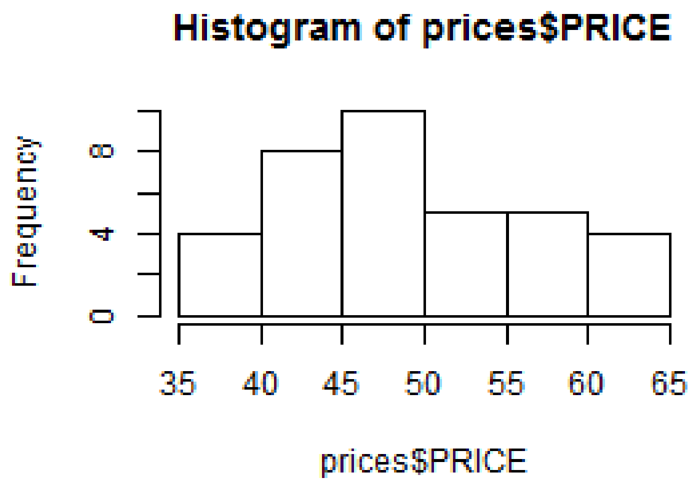
The estimated population, μ, from the sample mean, $\bar{x}$, is 49.2778.

8.2 Example 8.2, Introducing Confidence Intervals

```r
#read in the data
prices <- read.csv("data/Tb08-01.txt")
str(prices)
```

```
## 'data.frame': 36 obs. of  1 variable:
##  $ PRICE: num  53.8 54.4 45.2 42.9 49.9 48.2 41.6 58.9 48.6 53.1 ...
```

```r
hist(prices$PRICE, breaks = 5)
```




```
sum <- sum(prices$PRICE)
n <- nrow(prices)
mu <- sum / n
sigma <- 7.2
s <- sigma / sqrt(n)
cat(sum, n, mu, sigma, s)

## 1774 36 49.28 7.2 1.2

confidence.interval <- simple.z.test(prices$PRICE, sigma, conf.level = 0.9544)
confidence.interval

## [1] 46.88 51.68
```

8.3 Example 8.3, Interpreting Confidence Intervals

8.4 Example 8.1,

9 Chapter 9, Hypothesis Tests for One Population Mean

9.1 Example 9.1, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.2 Example 9.2, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.3 Example 9.3, Choosing the Null and Alternative Hypotheses

This example contains no code.

9.4 Example 9.4, The Logic of Hypothesis Testing

Null hypothesis is $H_0 : \mu = 454$.
Alternative hypothesis is $H_\alpha : \mu \neq 454$.

```
# load the data file
weights <- read.csv("data/Tb09-01.txt")
str(weights)

## 'data.frame': 25 obs. of  1 variable:
##  $ WEIGHT: int  465 456 438 454 447 449 442 449 446 447 ...

#declare and initialize variables
mu <- 454
sigma <- 7.8
n <- 25
xbar <- mean(weights$WEIGHT)
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest

## [1] -2.564

#determine the result of the test
result <- pnorm(ztest)
result

## [1] 0.005172

#use simple z test from UsingR package
library(UsingR)
conf.int <- simple.z.test(weights$WEIGHT, sigma = sigma, conf.level = 0.9544)
conf.int

## [1] 446.9 453.1
```

The claimed weight of the population is μ per bag, 454 grams. The mean sample weight is $\bar{x}$ per bag, 450 grams. The z value is -2.5641, which is more than two standard deviations below the population mean.

9.5 Example 9.5, Type I and Type II Errors

This example contains no code.

9.6 Example 9.6, Obtaining the Critical Values

```
left.tail <- qnorm(0.05)
left.tail
```

```
## [1] -1.645
```

```
right.tail <- qnorm(0.95)
right.tail
```

```
## [1] 1.645
```

```
two.tail.left <- qnorm(0.025)
two.tail.left
```

```
## [1] -1.96
```

```
two.tail.right <- qnorm(0.975)
two.tail.right
```

```
## [1] 1.96
```

9.7 Example 9.7, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = \$51.46$.
Alternative hypothesis is $H_\alpha :> \$51.46$

```
# load the data file
books <- read.csv("data/Tb09-05.txt")
str(books)
```

```
## 'data.frame': 40 obs. of  1 variable:
##  $ PRICE: num  56 46.2 47.3 54 53.7 ...
```

```
#declare and initialize variables
mu <- 51.46
sigma <- 7.61
n <- 40
xbar <- mean(books$PRICE)
right.tail = 0.01
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest
```

```
## [1] 2.851
```

```
right.crit <- qnorm(1 - right.tail)
right.crit
```

```
## [1] 2.326
```

The z statistic is 2.8508, which is greater than the critical value of 2.3263, so we reject the null hypothesis.

9.8 Example 9.8, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = 800$.
Alternative hypothesis is $H_\alpha :< 800$

```
# load the data file
rda <- read.csv("data/Tb09-06.txt")
str(rda)

## 'data.frame': 18 obs. of  1 variable:
##  $ CALCI: int  686 433 743 647 734 641 993 620 574 634 ...

#declare and initialize variables
mu <- 800
sigma <- 188
n <- 18
xbar <- mean(rda$CALCI)
left.tail = 0.05
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest

## [1] -1.187

left.crit <- qnorm(left.tail)
left.crit

## [1] -1.645
```

The z statistic is -1.1873, which is less than the critical value of -1.6449, so we do not reject the null hypothesis.

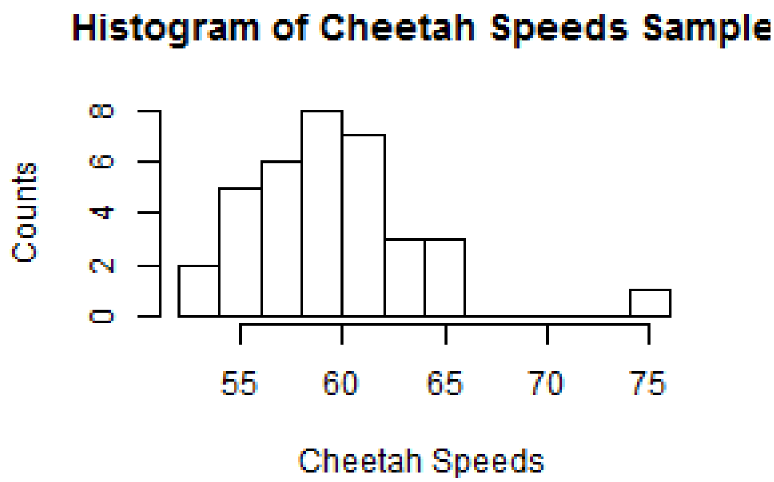
9.9 Example 9.9, The One-Sample z-Test

Null hypothesis is $H_0 : \mu = 60$.
Alternative hypothesis is $H_\alpha :\neq 60$

```
# load the data file
cheetah <- read.csv("data/Tb09-07.txt")
str(cheetah)

## 'data.frame': 35 obs. of  1 variable:
##  $ SPEEDS: num  57.3 57.5 59 56.5 61.3 57.6 59.2 65 60.1 59.7 ...

#histogram of the data set
hist(cheetah$SPEEDS, breaks = 15, xlab = "Cheetah Speeds", ylab = "Counts", main = "Histogram of
```




```r
#declare and initialize variables
mu <- 60
sigma <- 3.2
n <- 35
xbar <- mean(cheetah$SPEEDS)
tails = 0.05
ztest <- (xbar - mu) / (sigma / sqrt(n))
ztest
```

```
## [1] -0.8768
```

```r
crits <- qnorm(c( tails / 2, (1 - tails / 2)))
crits
```

```
## [1] -1.96  1.96
```

The z statistic is -0.8768, which is less than the critical values of -1.96, 1.96, so we do not reject the null hypothesis.

9.10 Example 9.10,

9.11 Example 9.11,

9.12 Example 9.12,

9.13 Example 9.13,

9.14 Example 9.14,

9.15 Example 9.15,

9.16 Example 9.16,

9.17 Example 9.17,

9.18 Example 9.18,

9.19 Example 9.19,

9.20 Example 9.20,

9.21 Example 9.21,

10 Chapter 10

11 Chapter 11